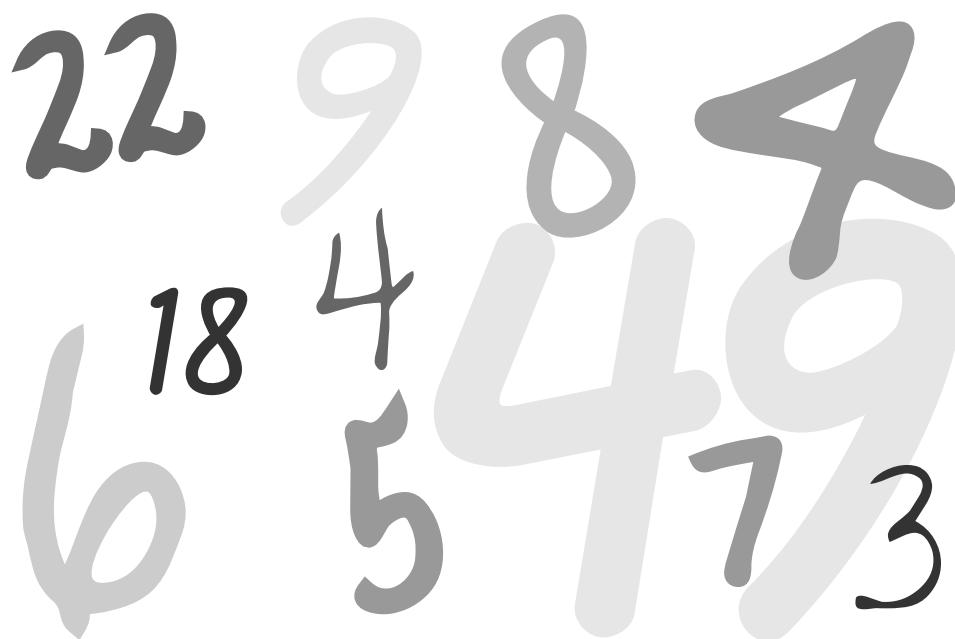


**Michigan Educational
Assessment Program
MEAP**



**Grade 8
Mathematics Assessment
Model**

April 2001

**Michigan State Board of Education and Department of Treasury
Statement of Assurance of Compliance With Federal Law**

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INTRODUCTION

This document, the Mathematics Assessment Model, is designed to communicate the substance and format of the new MEAP mathematics assessment for 2001–2. Audiences for this assessment model include students, parents, teachers, curriculum specialists, and administrators. The model represents a collaborative effort under the joint leadership of the Michigan Department of Treasury’s Michigan Educational Assessment Program and the Michigan Department of Education’s Curriculum Development Program Unit. Major review and input was further provided by content advisory committee members who played a substantial role in the development of the new mathematics tests.

PURPOSE OF THIS DOCUMENT

The primary purpose of this document is to acquaint all teachers of mathematics with the design of the assessment. The mathematics assessment was developed from, and is aligned with, *the Mathematics Standards of the Michigan Curriculum Framework*. A review of the released test form in this document will give teachers concrete examples of assessment items. Because these items are released, they will not appear in operational forms of the assessments. Each of the items included in the Assessment Model was drawn from items that were tested with a representative sample of Michigan students at grade 8 during the Fall 2000 item tryout. All portions of this document may be copied and distributed for educational use.

ORGANIZATION

The Mathematics Assessment Model contains four parts.

Part one includes introductory material that details the number, type, context, and point value of the assessment items. This first part represents the basic framework on which the assessment was built.

Part two of the Assessment Model contains a released form of the assessment. This model is a complete test form which represents what students will be given at the time of testing.

Part three contains a sample of student responses, scoring guides, and annotations on scoring.

Part four contains a glossary, a brief list of resources, and the names of individuals who were instrumental in the development of this mathematics assessment in Michigan.

PART ONE: FRAMEWORK OF THE ASSESSMENT

VISION FOR MATHEMATICS

A mathematically powerful individual should be able to:

- *reason mathematically;*
- *communicate mathematically;*
- *problem solve using mathematics; and*
- *make connections within mathematics and between mathematics and other fields.*

Mathematics is the science of patterns and relationships. It is the language and logic of our technological world. Mathematical power is the ability to explore, to conjecture, to reason logically and to use a variety of mathematical methods effectively to solve problems. The ultimate goal of mathematics education is for all students to develop mathematical power to participate fully as citizens and workers in our contemporary world.

The 15 standards listed in the *Mathematics Content Standards of the Michigan Curriculum Framework* establish expectations for what students should know and be able to do as a result of their mathematics education.

The Mathematics Content Standards are grouped into six categories called strands, which are further divided into content standards. These standards, expressed as attributes we envision for our graduates, are the intended results of students' experiences with a core curriculum. Students are expected to make continuous progress toward meeting the standards at each level of schooling. All standards should be pursued at every grade level of a school's core curriculum from kindergarten through graduation. Benchmarks are established for each standard to designate what students are expected to learn within grades K-4, 5-8, and 9-12 to indicate progress toward meeting these standards. The assessment is designed from a subset of these benchmarks determined to be "testable" on a statewide assessment.

COMPREHENSIVE ASSESSMENT

A comprehensive assessment system consists of a statewide, district, and classroom assessment, and performance standards that form a link to content standards and teaching and learning standards. No single assessment instrument can provide all the information needed to accomplish the ultimate purpose of assessment which is to improve teaching and learning. An integrated approach that is necessary and includes both mathematics content standards and benchmarks, assessed with the most appropriate methods available.

PURPOSE OF STATEWIDE ASSESSMENT

The statewide mathematics assessment is designed to provide information about student achievement in mathematics, promote assessment practices that support learning for all students, and foster curriculum and instruction that is aligned with the state *Mathematics Content Standards*. This assessment may be used by students, parents, teachers, school districts, researchers, and state government to advance the quality of mathematics education.

STANDARDS ASSESSED AT THE STATE LEVEL

Statewide assessment is based on the *Content Standards for Mathematics of the Michigan Curriculum Framework*. Figure 1 presents the 15 content standards to be assessed.

Patterns, Relationships and Functions	Geometry and Measurement	Data Analysis and Statistics	Number Sense and Numeration	Numerical and Algebraic Operations and Analytical Thinking	Probability and Discrete Mathematics
I.1 <i>Patterns</i>	II.1 <i>Shape and Shape Relationships</i>	III.1 <i>Collection, Organization and Presentation Of Data</i>	IV.1 <i>Concepts and Properties Of Numbers</i>	V.1 <i>Operations and Their Properties</i>	VI.1 <i>Probability</i>
I.2 <i>Variability and Change</i>	II.2 <i>Position</i>	III.2 <i>Description and Interpretation</i>	IV.2 <i>Representation and Uses Of Numbers</i>	V.2 <i>Algebraic and Analytical Thinking</i>	VI.2 <i>Discrete Mathematics</i>
	II.3 <i>Measurement</i>	III.3 <i>Inference and Prediction</i>	IV.3 <i>Number Relationships</i>		

Figure 1: Mathematical Standards to be Assessed

STANDARDS FOR THE ASSESSMENT DESIGN

Seven standards* were applied as criterion to guide the development of items for this assessment:

Organization of Information – The task asks students to organize, synthesize, interpret, explain, or evaluate complex information in addressing a concept, problem, or issue.

Consideration of Alternatives – The task asks students to consider alternative solutions, strategies, perspectives, or points of view in addressing a concept, problem, or issue.

Disciplinary Content – The task asks students to show understanding and/or use ideas, theories, or perspectives considered central to an academic or professional discipline.

Disciplinary Process – The task asks students to use methods of inquiry, research, or communication characteristics of an academic or professional discipline.

Communication – The task asks students to communicate their understandings, explanations or conclusions.

Problem Connected to the World Beyond the Classroom – The task asks students to address a concept, problem or issue similar to one they have encountered or are likely to encounter in life beyond the classroom.

Audience Beyond the School – The task asks students to communicate their knowledge, present a product or performance, or take some action for an audience beyond the teacher, classroom, and school building.

*These seven standards were adopted from the Center on Organization and Restructuring of Schools at the University of Wisconsin.

ITEM TYPES

The assessment features two types of items. Both require students to apply what they have learned and to analyze information presented by a prompt. The two types of items are:

- Selected response: Students select a response from four possible choices. These items can involve multiple steps and computations but generally require a short amount of time to complete.
- Constructed response: Students supply a solution to a problem to be evaluated in terms of both the final response and the approach used to reach that response. Multiple approaches to solving these problems are accepted and partial credit is granted for incomplete work. Effectively demonstrating one's work is critical. This work can be expressed in various forms, e.g., a narrative, calculations, charts, or graphs.

DISTRIBUTION OF ITEMS BY STRAND AND TYPE OF FORMAT

Figure 2 shows the distribution of test items by strand and item type. Selected-response items are worth 1 point and constructed-response items are worth 4 points. On the grade 8 test, 32 of the 48 points possible are assigned to selected-response items and 16 points assigned to constructed-response items. In other words, about 33% of the total score is attributed to constructed-response items.

Emphasis by Strand and Item-Type

STRAND	Middle School %
Patterns, Relationships, and Functions	20
Geometry and Measurement	20
Data Analysis and Statistics	20
Number Sense and Numeration	10
Numerical and Algebraic Operations and Analytical Thinking	20
Probability and Discrete Mathematics	10

Item Type	Items	Points	Percent Of Points
Selected-Response (1 point each)	32	32	67
Constructed-Response (4 points each)	4	16	33
Total Assessment	36	48	100

Figure 2: Distribution of Items Grade 8

CONTEXT FOR MIDDLE SCHOOL ITEM SELECTION

This test will address the “testable” portion of the state curriculum framework for middle school. Furthermore, only partial coverage of the total set of testable benchmarks is provided for in any single assessment.

The assessable content is defined in “Assessable Content: Content Standards and Benchmarks for Mathematics,” which can be reviewed on the Merit Website: www.meritaward.state.mi.us.

SAMPLE GRADE 8 ITEMS

To help educators anticipate the kinds of items being planned for state assessments, this document includes a complete released form of this test for grade 8.

The *Mathematics Assessment Model* reflects a commitment to constructed response items because these types of items are necessary to determine the extent to which students are meeting the *Model Content Standards for Mathematics*. Examples of scoring guides that might be used to score these items follow the released form in Part Three of this document.

ASSESSMENT REPORTS

The results of the mathematics assessments will be reported by the strands of the *Content Standards*. The following strands, or combination of strands, will be reported on the Middle School Test :

- Patterns, Relationships, and Functions
- Geometry and Measurement
- Data Analysis and Statistics combined with Probability and Discrete Mathematics
- Number Sense and Numeration combined with Numerical and Algebraic Operations and Analytical Thinking

TEACHING AND LEARNING STANDARDS

The connection between instruction and assessment is an important link in designing an assessment. The following instructional standards were considered in the design of the assessment.¹

Standard 1: Higher Order Thinking

Instruction involves students in manipulating information and ideas by synthesizing, generalizing, explaining, hypothesizing, or arriving at conclusions that produce new meanings and understandings for them.

Higher order thinking requires students to manipulate information and ideas in ways that transform their meaning and implications. This occurs when students combine facts and ideas in order to synthesize, generalize, explain, hypothesize or arrive at some conclusion of interpretation. Manipulating information and ideas through these processes allows students to solve problems and discover new meanings (for them) and understandings.

Lower order thinking occurs when students are asked to receive or recite factual information or to employ rules and algorithms through repetitive routines. As information receivers, students are given pre-specified knowledge ranging from simple facts and information to more complex concepts. Students are not required to do much intellectual work since the purpose of instruction is simply to transmit knowledge or to practice procedural routines.

Standard 2: Deep Knowledge

Instruction addresses central ideas of a topic or discipline with enough thoroughness to explore connections and relationships and to produce relatively complex understandings.

Knowledge is deep when central ideas of a topic or discipline are explored in considerable detail that shows interconnections and relationships. Knowledge is deep when, instead of being able to recite only fragmented pieces of information, students express relatively systematic, integrated or holistic understandings of central concepts. Mastery is demonstrated by students discussing relationships, solving problems, constructing explanations, and drawing conclusions.

Depth of knowledge and understanding can be indicated by the substantive character of the ideas that the teachers present in the lesson and by the level of understanding students demonstrate as they consider these ideas.

Standard 3: Substantive Conversation

Students engage in extended conversational exchanges with the teacher and/or with their peers about subject matter in a way that builds an improved and shared understanding of ideas or topics.

In classes characterized by high levels of substantive conversation there is sustained teacher-student and/or sustained student-student interaction about a topic. The interaction is reciprocal and it promotes coherent shared understanding. Substantive conversation has three features:

1. The talk is about subject matter in the discipline and includes higher order thinking such as making distinctions, applying ideas, forming generalizations, raising questions, not just reporting of experiences, facts, definitions, or procedures.
2. The conversation involves sharing of ideas and is not completely scripted or controlled by one party (as in teacher led recitation). Sharing is best illustrated when participants explain themselves or ask questions in complete sentences, and when they respond directly to comments of previous speakers.
3. The dialogue builds coherently on participants' ideas to promote improved, collective understanding of a theme or topic.

To recognize substantive conversation, we first define an interchange as a statement by one person and a response by another. The interchanges need not be between the same two people, but they must be linked substantively as consecutive responses.

Standard 4: Connections to the World Beyond the Classroom

Students make connections between substantive knowledge and either public problems or personal experiences.

A lesson gains in authenticity the more there is a connection to the larger social context in which students live. There are at least three ways in which student activity in classrooms can reflect some connections to life beyond school. First, lessons might focus on understanding a real-world, public problem of some contemporary significance; for example, applying statistical analysis in preparing a report to the city council on the homeless. Second, lessons can build upon students' personal experiences to connect to important ideas in the disciplines; for example, by comparing approaches to conflict resolution between people and nations. Finally, if students attempt to communicate their knowledge to others beyond the classroom, to influence or to assist others, school knowledge is more likely to have value beyond simply achieving success in school.

¹ *A Guide to Authentic Instruction and Assessment: Vision, Standards and Scoring* (1995) written by Fred M. Newmann, Walter G. Secada, and Gary G. Wehlage at the Wisconsin Center for Education Research.

PART TWO: RELEASED TEST FORM



GRADE 8 MATHEMATICS ASSESSMENT MODEL SPRING 2001

SAMPLE GRADE 8 ITEMS

To help educators anticipate the kinds of items being planned for state assessments, this document includes a complete released form of this test for grade 8. *While this form may be administered to students as a practice test, it should not be assumed to duplicate precisely the difficulty levels of any future live forms of the test.*

Directions

Day One: Mathematics Assessment

Directions to the Student

In this test you will demonstrate your understanding of mathematics. The test has three parts. You will have at least 35 minutes to finish each part of the test. You will be given additional time if necessary.

You must record your answers to **all** questions in your TEST BOOKLET.

Use only a No. 2 pencil to mark your answers. Circle the correct letter completely. If you erase an answer, be sure to erase the first circled letter completely. You may use calculators on this test.

You may use the MEAP Reference Sheet as you take this mathematics test. It includes formulas and diagrams that you may find useful.

There are two types of questions on this test:

1. Some questions will require you to choose the best answer from among four answer choices.
2. Some questions will require you to write, explain, or show your work in the space provided in your test booklet.

Here are some important things to remember as you take this test:

1. Read each question carefully and think about the answer.
2. If answer choices are given, choose the best answer by circling the letter in your test booklet.
3. If an answer space is provided in your test booklet, show all your work and write your answer neatly and clearly in the space provided.
4. You should have plenty of time to finish every question on the test. If you do not know the answer to a question, go on to the next question. You may return to that question later.
5. If you finish early, you may check your work in that part of the test **only**. Do **not** look at the questions in other parts of the test.
6. When you reach the word **STOP** in your test booklet, do **not** turn the page.

Once you have finished each part, close your test booklet and put down your pencil.

If you do not understand any of these directions, please raise your hand.

Sample Items

Sample Questions

To help you understand the test questions, look at the sample test questions that follow. These samples show you what the questions in the test are like and how to mark your answers.

Multiple-Choice Sample Question

For this type of question, you will determine the answer and circle the correct letter in your test booklet.

S1 How much sales tax is charged when you buy a shirt that costs \$12?

<u>PRICE OF ITEM</u>	<u>SALES TAX</u>
\$1	\$0.06
\$2	\$0.12
\$3	\$0.18
\$4	\$0.24

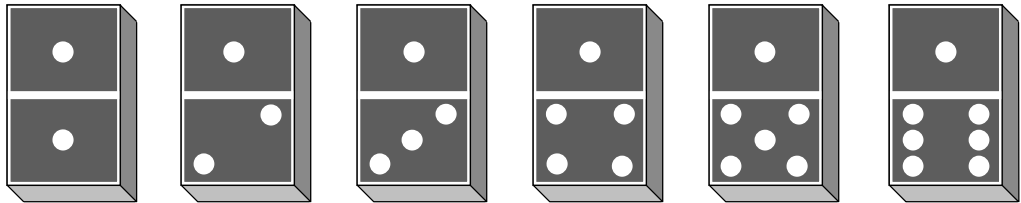
- A** \$0.60
- B** \$0.66
- C** \$0.72
- D** \$0.78

For this sample question, the correct answer is **C**.

Open-ended Sample Question

For this type of question, you will write, explain, or show all your work in the space provided in your test booklet.

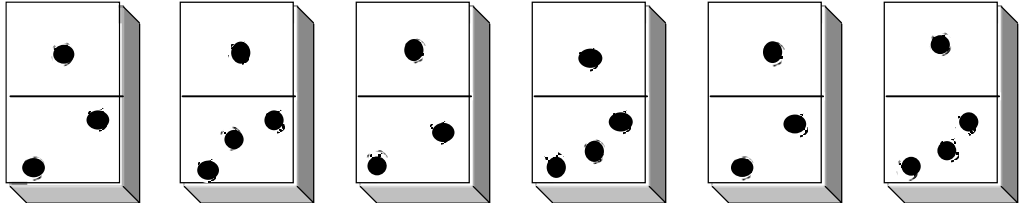
S2 Solve the following problem.



A What pattern do these dominoes display?

They all have one on top. At the bottom it starts with one and keeps adding one on each 'til it reaches six.

B Draw another domino pattern different from the one above.



C Describe the pattern you drew.

On the first, third, and fifth, dominos I drew one on top and two on bottom. On the second, fourth, and sixth, I put one on top and three on the bottom.

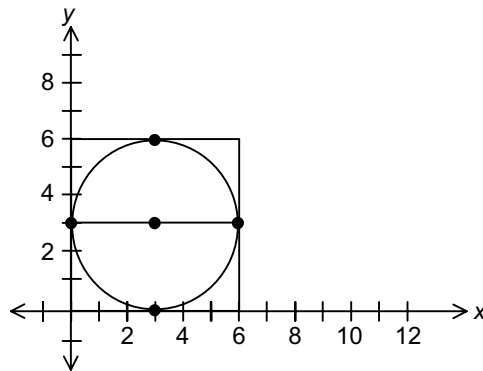
For this sample question, you would answer Part A by explaining that they all have one on top. At the bottom it starts with one and keeps adding one on each consecutive domino. For Part B, you would draw a different domino pattern than the one above. Remember to show your work. For Part C, you would explain or describe the pattern you drew.

Grade 8—Part I

1 In which set are the numbers equivalent?

- A** $\frac{1}{3}$, $\frac{3}{27}$, 33%
- B** 0.090, 90%, 0.90
- C** 88%, $\frac{88}{100}$, $\frac{22}{25}$
- D** 0.66%, $\frac{2}{3}$, 66.7%

2 Which coordinate point satisfies the following requirements: serves as an endpoint of the given diameter, and does **NOT** lie on the y -axis?



- A** (0, 3)
- B** (6, 3)
- C** (3, 6)
- D** (3, 0)

Grade 8—Part I

- 3** Winnona took five chapter tests. The table shows her scores.

Test	1	2	3	4	5
Score	86	90	80	79	70

If Winnona retakes Test 5, what score would she need to have a mean score of 84?

- A** 85
 - B** 84
 - C** 83.8
 - D** 83.75
- 4** As a reward for good behavior, Mrs. Rafferty writes student names on tickets and stores them in a container. At the end of the week, she draws a ticket for a reward.

Hans has 6 tickets in the container. The container has a total of 48 tickets for this week. What is the probability that one of his tickets will be drawn?

- A** 1 out of 6
- B** 1 out of 8
- C** 1 out of 48
- D** 1 out of 54

Grade 8—Part I

- 5** A triangle has 0 diagonals, a quadrilateral has 2 diagonals, a pentagon has 5 diagonals, and a hexagon has 9 diagonals. If the pattern continues, how many diagonals will an octagon have?

Sides	3	4	5	6
Diagonals	0	2	5	9

- A** 11
B 14
C 18
D 20
- 6** Brandi and Charles painted an 8 ft by 18 ft mural on a school wall. They decided to paint a one foot border around the outside edge of the mural. What is the area of the border?
- A** 60 sq ft
B 56 sq ft
C 30 sq ft
D 26 sq ft

Grade 8—Part I

- 7** The expenses for a school play total \$660. The drama club members wish to determine how many tickets must be sold to cover their expenses.

Number Of Tickets Sold (x)	Total Cost Of Tickets
5	\$27.50
6	\$33.00
10	\$55.00
11	\$60.50
12	\$66.00

Using the table, which equation represents the situation?

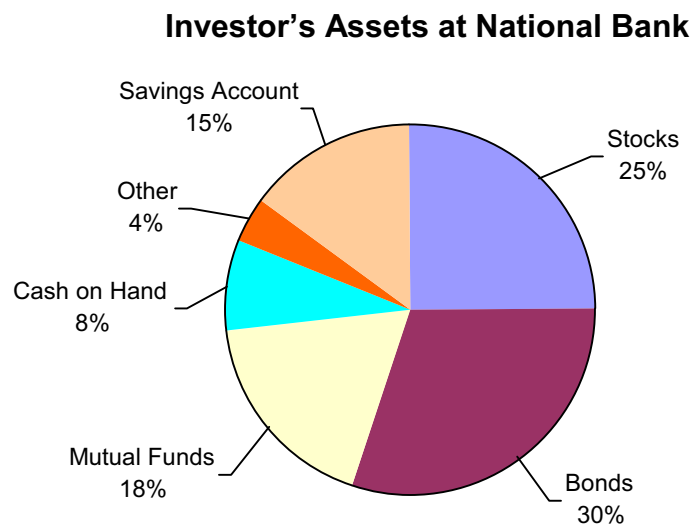
- A** $5.5x = 660$
 - B** $x + 5.5 = 660$
 - C** $660x = 5.5$
 - D** $660 - x = 5.5$
- 8** Which set of ordered pairs represents a constant rate of change?
- A** (0,1), (1,2), (2,3), (3,4)
 - B** (0,0), (2,3), (4,6), (5,7)
 - C** (0,1), (1,2), (3,4), (6,8)
 - D** (0,0), (1,2), (4,5), (7,8)

Grade 8—Part I

- 9** This weekend Leo plans to call his best friend in New York. He can call either Friday evening or Saturday afternoon. The cost is \$0.07 per minute Friday, or \$0.12 per minute Saturday. If he plans to keep the cost below \$2.55, about how much longer can he talk on Friday?

A 12 minutes
B 15 minutes
C 21 minutes
D 36 minutes

- 10** The graph shows the distribution of investors' assets.



If there is \$1,200 in the category Cash on Hand, how much money is in the category Stocks?

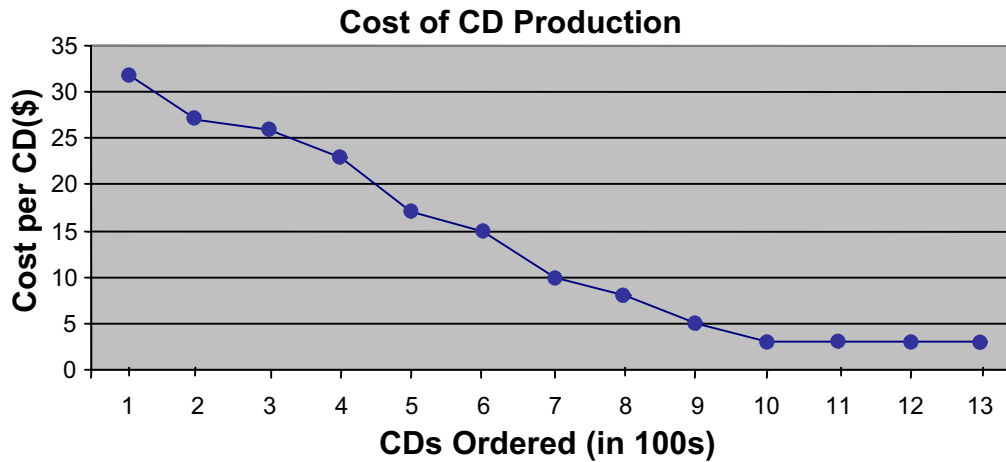
A \$2,550
B \$3,000
C \$3,600
D \$3,750

Grade 8—Part I

- 11** A complete cycle of a traffic light takes 70 seconds. During each cycle, the light is red for 25 seconds, yellow for 10 seconds, and green for 35 seconds. What is the probability the light will **NOT** be yellow if a car randomly arrives at the traffic light?

- A** $\frac{1}{7}$
B $\frac{5}{14}$
C $\frac{6}{7}$
D $\frac{1}{2}$

- 12** The chart shows the cost for producing compact discs (CDs).



According to the chart, what is the minimum order of CDs necessary to reach the lowest price per CD?

- A** 100
B 800
C 1,000
D 1,300

- 13** Julio and Irene are running a five-kilometer race. The chart shows their running times for the first 3 kilometers.

Running Times		
Kilometers	Julio	Irene
1st	6 min 0 sec	6 min 55 sec
2nd	6 min 10 sec	6 min 40 sec
3rd	6 min 20 sec	6 min 25 sec
4th		
5th		
Total time		

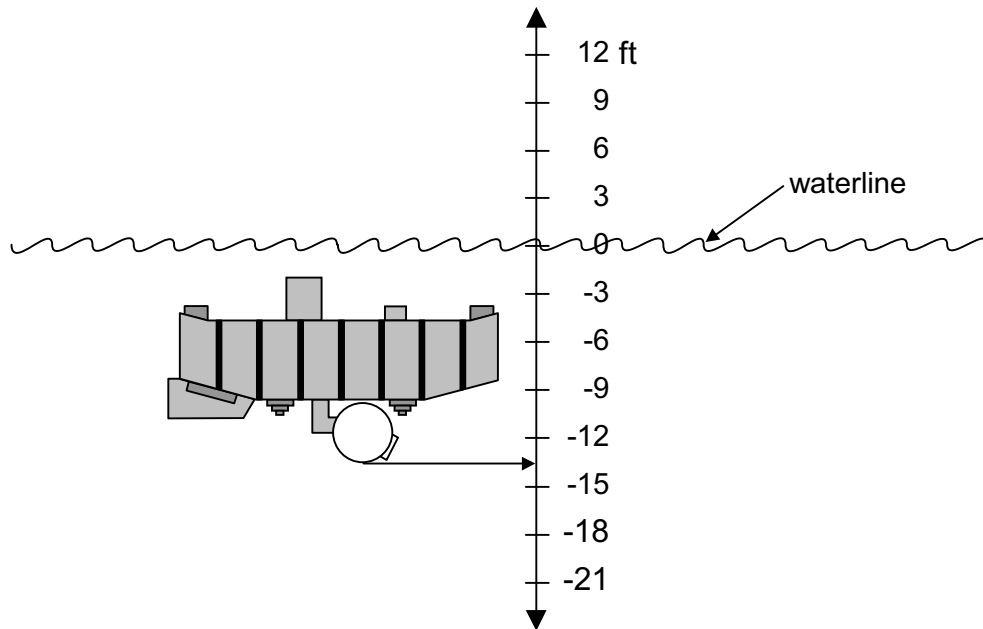
Complete the following 2 parts. Show all your work.
Suppose their patterns continue.

- A** Determine the pattern and the remaining running times for Julio and Irene.

- B** Who finishes first? By how many seconds?

Grade 8—Part II

- 14** This machine helps explorers investigate under water. Leah needs to move the machine 3 feet deeper.



At what depth would the bottom of the machine be after the move?

- A** at -15
B below -18
C above -12
D between -15 and -18
- 15** Carolyn sells Great Taste cookies for \$2.50 a box. The Park family bought 8 boxes. How many more boxes of cookies must she sell in order to collect \$160?
- A** 20
B 56
C 64
D 72

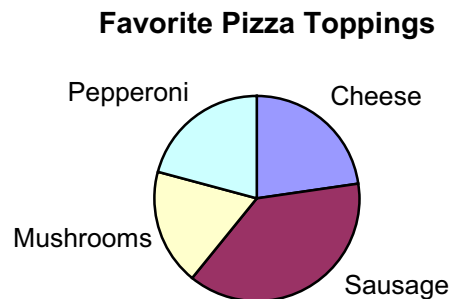
Grade 8—Part II

- 16 Students in a science class discovered the following pattern in nature.

$$\left\{ \frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{4}{5}, \dots \right\}$$

Which expression represents any number in this sequence?

- A $\frac{n}{(n+1)}$
- B $\frac{n}{n^2}$
- C $\frac{1}{(n+1)}$
- D $\frac{1}{n^2}$
- 17 The graph shows the result of a survey to determine which ingredient was most preferred as a pizza topping.

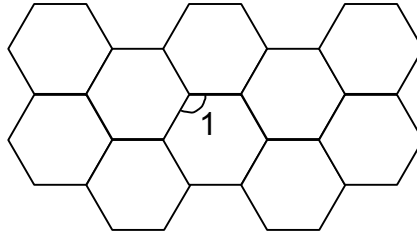


What information would help you determine the number of people who preferred sausage?

- A number of people surveyed and type of survey used to gather data
- B type of survey used to gather data and ages of people surveyed
- C percent values shown on chart and number of people surveyed
- D ages of people surveyed and percent values shown on chart

Grade 8—Part II

- 18** Honeycomb cells are usually contained within a pattern of regular hexagons, as shown below.



What is the measure of $\angle 1$ in the figure?

- A** 100°
 - B** 115°
 - C** 120°
 - D** 135°
- 19** Bill orders the Surprise Dessert at a dessert table.

Topping Choices

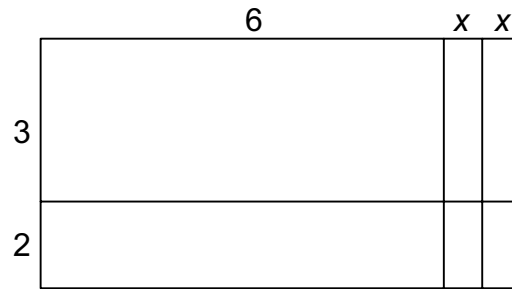
Fruit	Strawberry, Blueberry, Pineapple
Nuts	Peanuts, Pecans, Walnuts, Almonds

If the dessert comes with one fruit and one nut topping, what is the probability of getting strawberries and walnuts?

- A** $\frac{1}{3}$
- B** $\frac{1}{4}$
- C** $\frac{1}{7}$
- D** $\frac{1}{12}$

Grade 8—Part II

- 20** John created this diagram of a field.



Which expression represents the area of the diagram?

- A** $30 + 13x$
 - B** $30 + 36x^2$
 - C** $30 + 24x$
 - D** $30 + 10x$
- 21** Coach Minter's team plays 35 games a season. The chart shows his team's record for his first 3 seasons.

Team Record

Season	Wins	Losses
1st	12	23
2nd	15	20
3rd	18	17

If the above pattern continues, which of these would be Coach Minter's win-loss record for his sixth season?

- A** $23 - 12$
- B** $25 - 10$
- C** $27 - 8$
- D** $29 - 6$

Grade 8—Part II

- 22** A parallelogram can be drawn many different ways.

Complete the following 2 parts. Show all of your work.

A Using your ruler, draw a parallelogram with at least one right angle.

B Identify 3 other characteristics of your parallelogram.

- 23** Carlos enjoys renting movies. The local video store offers two pricing plans to its customers as shown below.

Plan 1	Plan 2
Each video rental is \$3	Annual membership fee of \$30 Each video rental is \$2

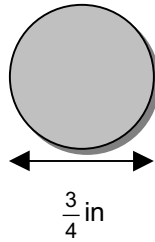
Complete the following 2 parts. Show all of your work and explain your answer.

A How many rentals are needed to make Plan 2 more economical than Plan 1?

B Give an example where Plan 1 would be more economical than Plan 2 and explain your reasoning.

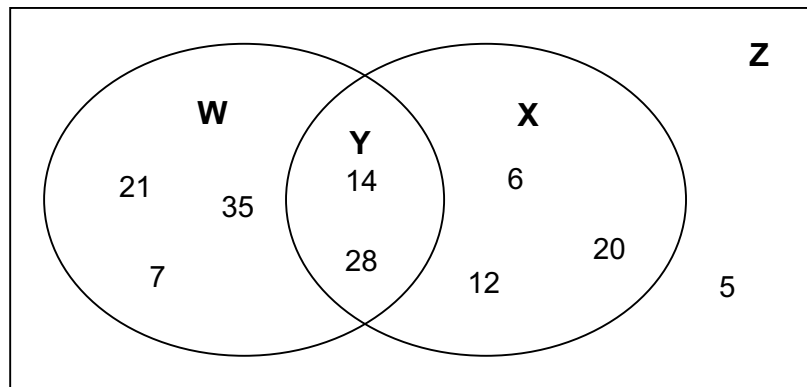
Grade 8—Part III

- 24** Marcus sees an offer for a flying disc on the back of a cereal box. He wants to use the picture on the box to determine the actual size of the flying disc.



The box indicates that the picture shown is in a 1:16 ratio. What is the actual diameter of the flying disc?

- A** 10 inches
B 12 inches
C 14 inches
D 16 inches
- 25** Erin discovered a relationship between numbers. The Venn diagram shows how Erin sorted a group of numbers. Using the Venn diagram, where should Erin put the number 49?



- A** in section W
B in section X
C in section Y
D in section Z

Grade 8—Part III

- 26** Beverly and her 3 sisters take care of their backyard this summer. The yard is divided into four parts as shown.

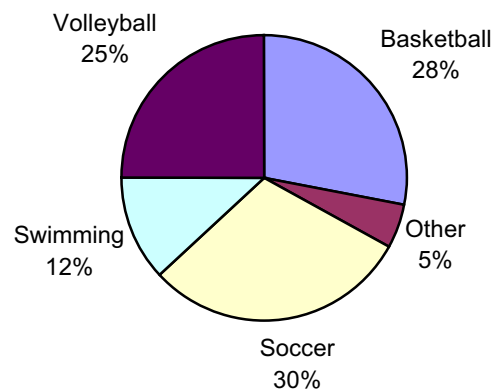
1	2
3	4

1 = 25 sq ft
2 = 45 sq ft
3 = 15 sq ft
4 = ???

If part 1 is square, what is the area of 4?

- A** 20 sq ft
B 25 sq ft
C 27 sq ft
D 29 sq ft
- 27** Ms. Hattori's class surveyed 8th grade students regarding their favorite sports. The graph shows the results.

Favorite Sports of 8th Grade Students

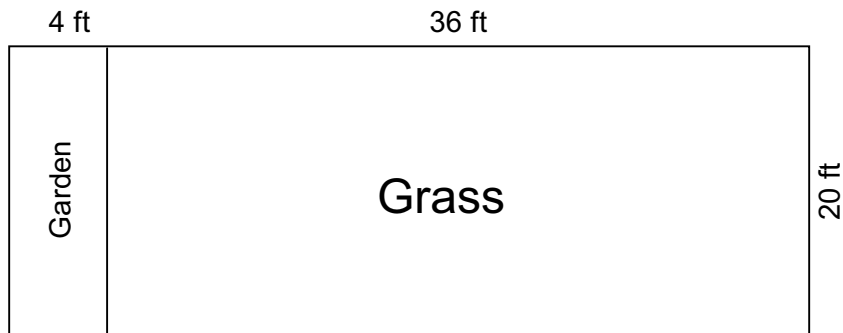


The students surveyed 80 additional 8th grade students. Which of these is the best prediction for the number of those 80 students who would choose swimming as their favorite sport?

- A** 6
B 9
C 12
D 16

Grade 8—Part III

- 28** Mr. and Mrs. Jackson’s yard measures 40 ft by 20 ft. Mr. Jackson’s garden in this yard measures 20 ft by 4 ft.



How much will the grass area decrease if he adds 2 more feet to his garden?

- A** 40 sq ft
B 80 sq ft
C 120 sq ft
D 240 sq ft
- 29** Look at the exact computation below.
- $$69 \div 6 = 11.5$$
- Which of the following situations would yield an answer of 12?
- A** determining the number of 6-flower bouquets that can be made from 69 flowers
B determining the number of 6-passenger vans needed to transport 69 people
C determining the amount of money 6 people receive when sharing \$69
D determining the average cost of 6 items that have a total cost of \$69

Grade 8—Part III

- 30** Patricia's house has a backyard in the shape of a square. Patricia divided the backyard into two sections with one straight fence. Which shapes could **NOT** be made?
- A** two squares
 - B** two triangles
 - C** two trapezoids
 - D** two rectangles
- 31** Peggy designed a game of chance. She played 40 games the first day and won 18 of them. She played 60 games the second day, winning 34. The last day, she played 25 games and won 10. Based on these results, what would be the probability of winning this game?
- A** 125.0%
 - B** 62.0%
 - C** 56.7%
 - D** 49.6%

Grade 8—Part III

- 32** Michelle is 13 years old. When she was 7, she received 50¢ a week allowance for doing her chores. On her 8th birthday, her weekly allowance increased to \$1.00 a week. When she was 9, her allowance increased to \$1.75 a week. At age 10, her allowance was \$2.75. If this pattern continued, how much is her weekly allowance now?

A \$5.50
B \$5.75
C \$7.25
D \$16.00

- 33** Carrie went to a new sandwich shop and saw the following menu:

Breads	Meats	Chips	Drinks
French	Turkey	Plain	Cola
Sourdough	Ham	Spicy	Root Beer
Wheat	Bologna	Corn	Orange
	Roast Beef		

Choosing one item from each column, how many different combinations could Carrie order?

A 13
B 27
C 54
D 108

- 34** Mario works at a local restaurant. After he works 30 hours, he earns overtime pay. His regular pay is \$9 per hour. Overtime pay is $1\frac{1}{2}$ times the regular pay. He hopes to earn more than \$350 next week. How many hours of overtime must he work?
- A** 6
B 32
C 36
D 80
- 35** Rick babysits for a neighbor. He earned \$58.00, which was \$4.00 more than twice the previous week's earnings. Which equation shows the amount he earned last week? (x = amount of previous week's earnings)
- A** $58 = 2(4) + x$
B $4x + 58 = 2x$
C $2(58) + 4 = x$
D $2x + 4 = 58$

Grade 8—Part III

- 36** When studying bridges in science class, the students came across the following comparison of some notable modern bridges.

Notable Modern Bridges			
Name	Location	Length of Main Span (feet)	Year Completed
Benjamin Franklin	Delaware River at Philadelphia, PA	1,750	1926
Ambassador International	Detroit River at Detroit, MI	1,850	1929
George Washington	Hudson River at New York City, NY	3,500	1931
San Francisco-Oakland Bay	San Francisco Bay	2,310	1936
Golden Gate	San Francisco Bay	4,200	1937
Bronx-Whitestone	East River, NY	2,300	1939
Tacoma Narrows II	Puget Sound at Tacoma, WA	2,800	1950
Delaware Memorial	Delaware River near Wilmington, DE	2,150	1951-1968
Walt Whitman	Delaware River at Philadelphia	2,000	1957
Mackinac Bridge	Straits of Mackinac at Mackinaw City, MI	3,800	1957
Seaway Skyway	St. Lawrence River at Ogdensburg, N.Y.	2,150	1960
Throgs Neck	East River, New York City	1,800	1961
Verrazano-Narrows	Lower New York Bay	4,260	1964

Complete the following 2 parts. Show all of your work.

- A** Construct a graph that will compare the length of the main spans of the 5 longest bridges in the chart.

- B** Justify your choice of graph.

PART THREE: SCORING

This section includes sample student responses, scoring guides, and annotations on scoring for each score point on each open-ended item.

It is important to note that these sample student responses are not the only way a student can earn a particular score. They are representative of the types of responses elicited by the item. The focus is on how to relate a specific response to the scoring guide for that problem.



#13

STUDENT RESPONSES AND SCORING

A **4-point** response does all of the following to earn 8 value points:

- Determines the pattern and accurately finds the running times for the 4th and 5th kilometers (each correct time is worth 1 value point for a total of 4 value points)

Kilometers	Julio	Irene
4th	6 min 30 sec	6 min 10 sec
5th	6 min 40 sec	5 min 55 sec
Total time	31 min 40 sec	32 min 5 sec

- Accurately adds the times in each column to determine the total running time for each runner (each total is worth 1 value point for a total of 2 value points)
(Note: Total times should be based on the results in the table. A student should earn these points if he or she correctly adds the times in his or her table, even if one or more entry is incorrect.)
- Correctly indicates which runner finished first and by how many seconds, based on the total times recorded in the table (Julio finished first by 25 seconds) (2 value points)

A **3-point** response earns 6-7 value points as defined in the 4-point response.

A **2-point** response earns 4-5 value points as defined in the 4-point response.

A **1-point** response shows some understanding of the problem and earns 2-3 value points as defined in the 4-point response.

A **0-point** response shows little or no understanding of the content of the item or leaves the item blank.

Student Response (4 points)

<i>Kilometers</i>	<i>Julio</i>	<i>Irene</i>	A
<i>1st</i>	<i>6 min 0 sec</i>	<i>6 min 55 sec</i>	
<i>2nd</i>	<i>6 min 10 sec</i>	<i>6 min 40 sec</i>	
<i>3rd</i>	<i>6 min 20 sec</i>	<i>6 min 25 sec</i>	
<i>4th</i>	<i>6 min 30 sec</i>	<i>6 min 10 sec</i>	
<i>5th</i>	<i>6 min 40 sec</i>	<i>5 min 55 sec</i>	
<i>Total time</i>	<i>31 min 40 sec</i>	<i>32 min 5 sec</i>	B
	55	60	
10	55	60	
20	40	60	
30	25	<u>180</u>	
40	10	3	
<u>100</u>	<u>185</u>	60 ³ 185	C
<i>31 min 40 sec</i>	<i>29 min</i>	<i>32 min 5 sec</i>	
<i>Julio finishes first by 25 seconds</i>			

Score 4

This is a 4-point response because the student **(A)** correctly determines the running times for the 4th and 5th kilometers, **(B)** accurately adds the times in each column to determine total running time, and **(C)** correctly indicates which runner finished first and by how many seconds.

Student Response (3 points)

Running Times		
Kilometer	Julio	Irene
1st	6min 0sec	6min 55sec
2nd	6min 10sec	6min 40sec
3rd	6min 20sec	6min 25sec
A 4th	6min 30sec	6min 10sec
5th	6min 40sec	5min 55sec
B total time	35min 100sec	29min 185sec
Total all together	36min 40sec	32min 5sec

C. Who finishes first? That would be Irene.
How many seconds? That would be by 275 seconds.

Julio
 $36 \times 60 = 2160 + 40 = 2200$

Irene
 $32 \times 60 = 1920 + 5 = 1925$

Julio Irene
 $2200 - 1925 = 275 \text{ seconds.}$

Score 3

This is a 3-point response because the student earned 7 value points by **(A)** correctly determining the running times for the 4th and 5th kilometers, **(B)** accurately adding the times in **one** column to determine total running time, and **(C)** correctly indicating which runner finished first and by how many seconds, based on the total times given.

Student Response (2 points)

<p><i>A. Irene – 6 min & 10 sec.</i></p> <p><i>5 min & 55 sec.</i></p> $\begin{array}{r} 25 \\ -15 \\ \hline 10 \end{array}$ $\begin{array}{r} 10 \\ -15 \\ \hline -5 \end{array}$ <p><i>Julio - 6 min 30 sec</i></p> <p><i>6 min 40 sec</i></p> $\begin{array}{r} 20 \\ +10 \\ \hline 30 \end{array}$ $\begin{array}{r} 30 \\ +10 \\ \hline 40 \end{array}$ <p><i>B. Irene by 15 seconds</i></p>	A
---	----------

Score 2

This is a 2-point response because the student earned 4 value points by **(A)** correctly determining the running times for the 4th and 5th kilometers.

Student Response (1 point)

Running Times		
KM	Julio	Irene
1st	6min	6min 55 sec
2nd	6min 10 sec	6min 45 sec
3rd	6min 20 sec	6min 35 sec
4th	6min 30 sec	6min 25 sec
5th	6min 40 sec	6min 15 sec
Total	6min 40 sec	6min 15sec

A

B. Irene won.

C

Score 1

This is a 1-point response because the student earned 3 value points by **(A)** correctly determining the running times for Julio's 4th and 5th kilometers, and **(C)** correctly indicating which runner finished first based on the total times indicated.

Student Response (0 points)

<p><i>A. Julio gets slower by some seconds each time and Irene gets faster each time.</i></p> <p><i>B. Julio won with 31 min 0 sec. to Irene 31 min 25 sec. He won by 85 sec.</i></p>	<p>C</p>
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Score 0

This is a 0-point response because the student earned 1 value point by **(C)** correctly indicating which runner finished first based on the total times indicated.

#22

STUDENT RESPONSES AND SCORING

A **4-point** response does all of the following:

- Accurately draws a parallelogram with at least one right angle (i.e., a rectangle)



- Identifies three valid characteristics of the drawing (e.g., both pairs of opposite sides are congruent, both pairs of opposite sides are parallel, both pairs of opposite angles are congruent, all of the angles are congruent and/or are right angles, etc.)

A **3-point** response does one of the following or similar:

- Accurately draws a parallelogram with at least one right angle (i.e., a rectangle) and identifies two valid characteristics of the drawing
- Draws a non-rectangular parallelogram but gives three valid characteristics of a parallelogram

A **2-point** response does one of the following or similar:


- Accurately draws a parallelogram with at least one right angle (i.e., a rectangle) and identifies one valid characteristic of the drawing
- Draws a non-rectangular parallelogram or a quadrilateral with a right angle that is not a parallelogram but gives two valid characteristics of the shape drawn

A **1-point** response does one of the following or similar:

- Accurately draws a parallelogram with at least one right angle (i.e., a rectangle)
- Draws a non-rectangular parallelogram or a quadrilateral with a right angle that is not a parallelogram but gives one valid characteristic of the shape drawn

A **0-point** response shows little or no understanding of the content of the item or leaves the item blank.

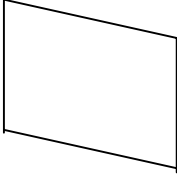
Student Response (4 points)

<p>A. </p> <p>B. <i>all sides congruent</i> <i>4 right angles</i> <i>4 sides</i> <i>4 vertices</i></p>	<p>A</p> <p>B</p>
---	---------------------------------

Score 4

This is a 4-point response because the student **(A)** accurately draws a parallelogram with at least one right angle and **(B)** correctly identifies 3 valid characteristics of their drawing.

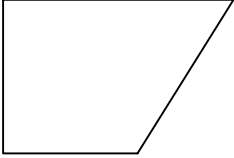
Student Response (3 points)

<p>A. </p> <p>B. <i>1. opposite sides are parallel to each other</i> <i>2. the shape has 2 obtuse angles which are 105°</i> <i>3. the shape has 2 acute angles which are 75°</i></p>	<p>A</p> <p>B</p>
---	---------------------------------

Score 3

This is a 3-point response because the student **(A)** draws a non-rectangular parallelogram and **(B)** correctly identifies 3 valid characteristics of a parallelogram.

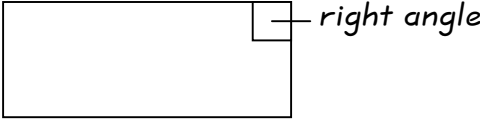
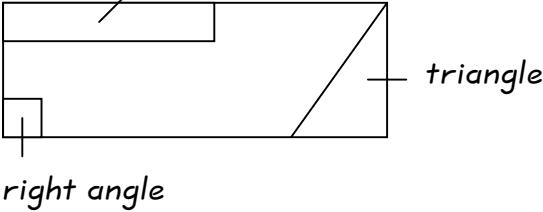
Student Response (2 points)

<p>A. </p>	<p>A</p>
<p>B. <i>1. By drawing a right angle it's not a parallelogram any more</i> <i>2. It has more than one right angle</i> <i>3. It also has a 60° angle in it</i></p>	<p>B</p>

Score 2

This is a 2-point response because the student **(A)** draws a quadrilateral with at least one right angle and **(B)** correctly identifies 2 valid characteristics of their drawing (the students' point 1. is not a valid characteristic).

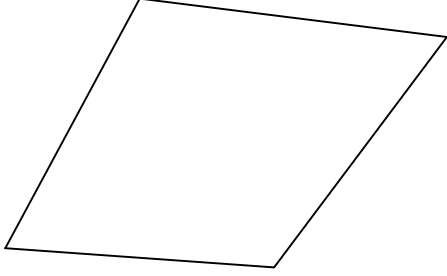
Student Response (1 point)

<p>A.</p>  <p>B.</p> 	<p>A</p>
---	-----------------

Score 1

This is a 1-point response because the student (**A**) draws a parallelogram with at least one right angle.

Student Response (0 points)

<p>A.</p>  <p>B.</p> <ol style="list-style-type: none">1. They are straightly-drawn slanted lines2. It has an obtuse angle3. $\begin{array}{r} 1 \\ 2.5 \\ \times 3 \\ \hline 7.5 \end{array}$ It's area is 7.5	
---	--

Score 0

This is a 0-point response because the student does not meet the requirements of a 1-point response.

#23

STUDENT RESPONSES AND SCORING

A **4-point** response does all of the following:

- Correctly indicates that at least 31 rentals are needed to make Plan 2 more economical
- Gives a reasonable explanation to support the previous answer (e.g., Solving the equation $3x = 30 + 2x$, you get $x = 30$. The plans cost the same amount for 30 rentals. However, if you have 31 or more rentals, Plan 2 would be better because you pay less for each additional rental.)
- Gives a valid example where Plan 1 would be more economical (e.g., 27 rentals)
- Provides a logical explanation for the above example (e.g., Under Plan 1 you would pay $\$3 \times 27 = \81 and under Plan 2 you would pay $\$30 + (\$2 \times 27) = \$84$. If you have less than 30 rentals, Plan 1 is more economical because you are not paying the membership fee and instead only pay for each rental.)

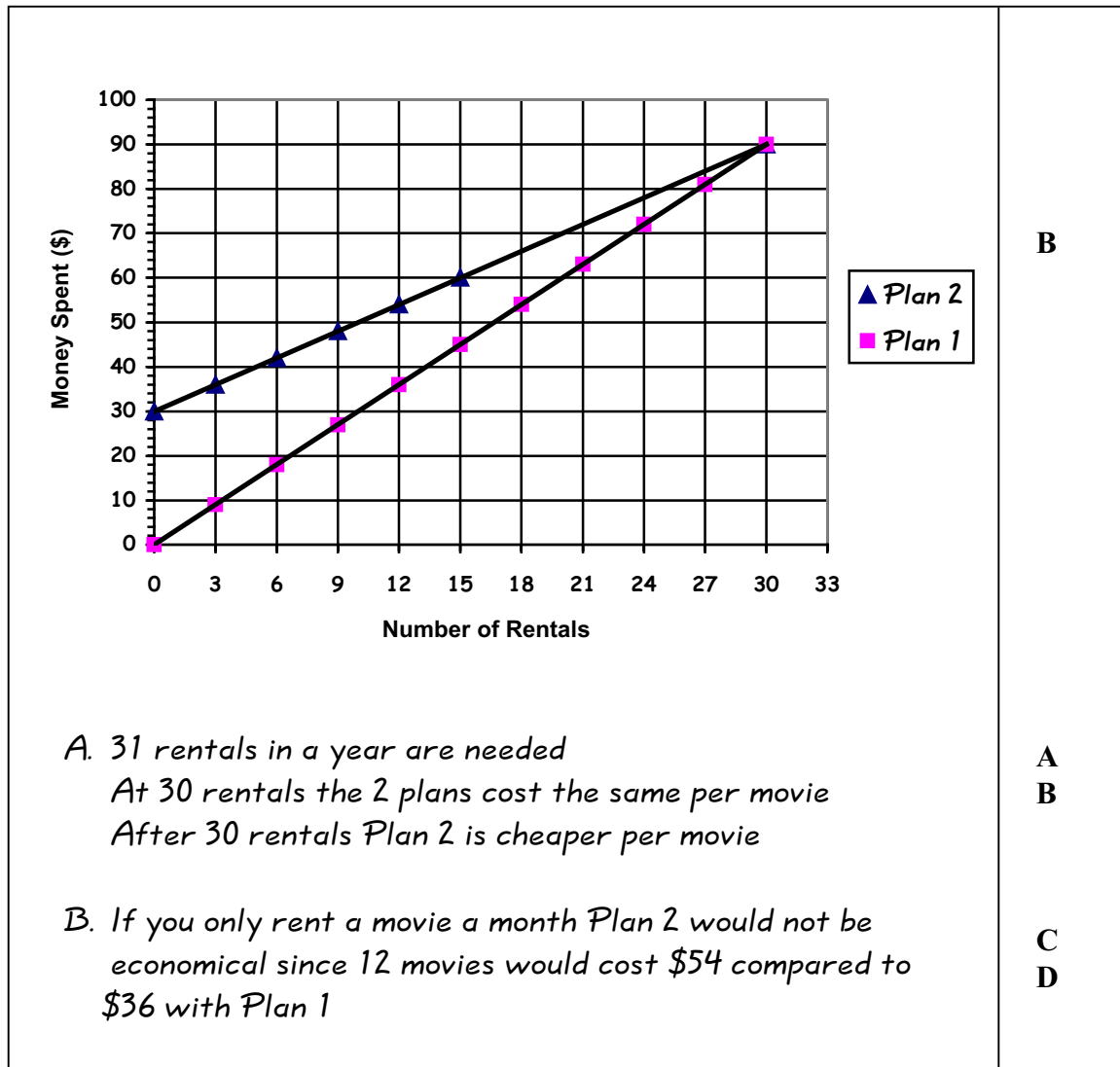
A **3-point** response completes three of the requirements listed in the 4-point response.

A **2-point** response completes two of the requirements listed in the 4-point response.

A **1-point** response completes one of the requirements listed in the 4-point response.

A **0-point** response shows little or no understanding of the content of the item or leaves the item blank.

Student Response (4 points)



Score 4

This is a 4-point response because the student **(A)** correctly indicates that at least 31 rentals are needed, **(B)** gives a reasonable explanation to support that answer **(C)** gives a valid example where Plan 1 would be more economical, and **(D)** provides a logical explanation for this example.

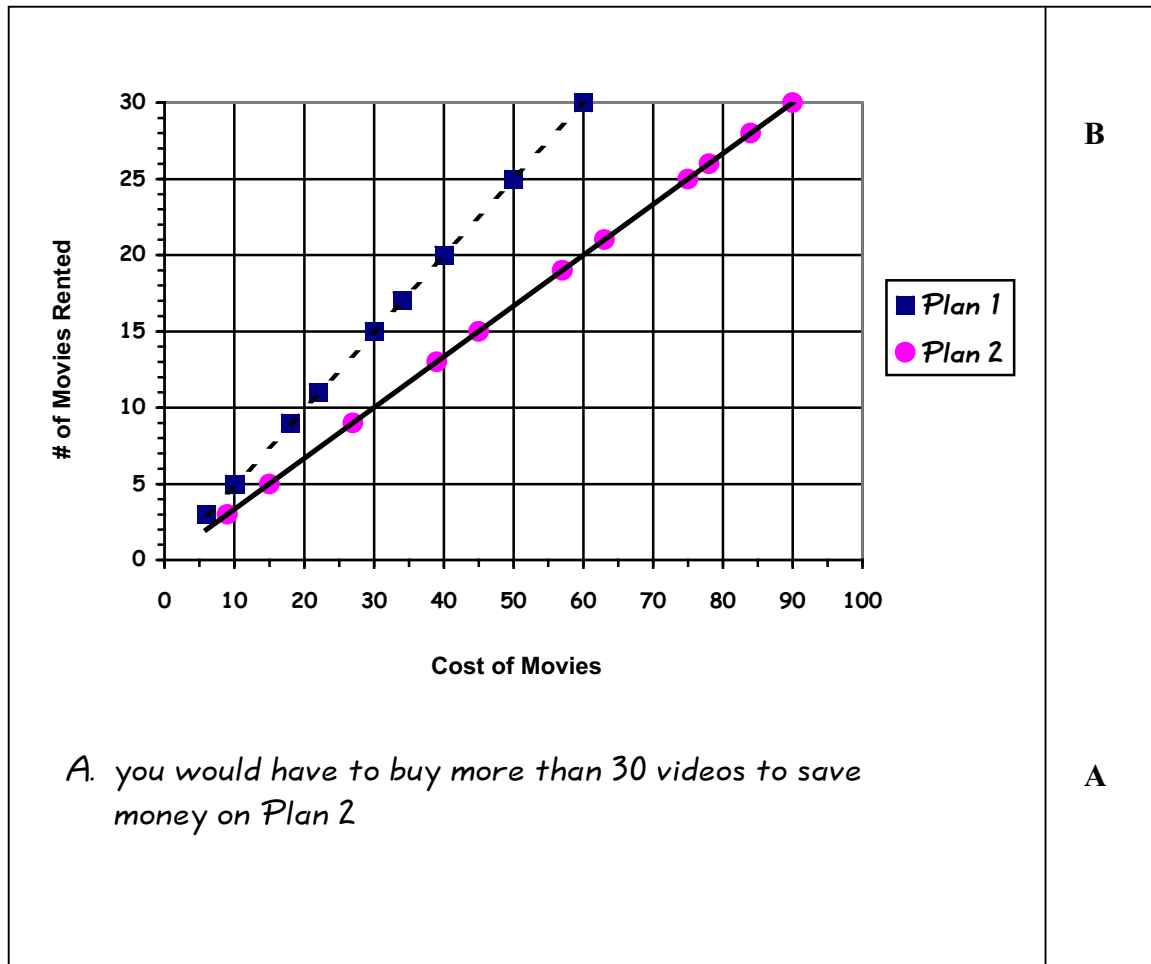
Student Response (3 points)

<i>A. 31 rentals because if you have less Plan 1 will cost less than Plan 2. For example, 11 rentals = \$33 with Plan 1. With Plan 2, it is \$52. 31 rentals, with Plan 1 = \$93 and with Plan 2 it = \$92.</i>	A
<i>B. 15 rentals with Plan 1 = \$45 and with Plan 2 it = \$60, so Plan 2 costs more, making Plan 1 more economical. 15(3) = 45 15(2) + 30 = 60</i>	C D

Score 3

This is a 3-point response because the student (**A**) correctly indicates that at least 31 rentals are needed, (**C**) gives a valid example where Plan 1 would be more economical, and (**D**) provides a logical explanation for this example. The explanation for the first answer is incomplete.

Student Response (2 points)



Score 2

This is a 2-point response because the student (**A**) correctly indicates that more than 30 rentals are needed and (**B**) gives reasonable support for the answer. (Note: The \$30 cost of Plan 1 is inferred by the endpoints of the graphs.)

Student Response (1 point)

<i>Plan 2 would be more economical if you rented a lot of movies</i> <i>Plan 1 would be better if you only rented 2 or 3 movies.</i>	C
---	----------

Score 1

This is a 1-point response because the student (**C**) gives a valid example where Plan 1 would be more economical.

Student Response (0 points)

<p><i>A: $\\$30 / \\$2 = 15$ $15 \times 3 = 45$ $15 \times \\$2 = \\30 $\\$45$ for 15 movies 15 movies for $\\$30$</i></p> <p><i>B. You wouldn't have to rent movies when you do not want to. If you only rent 15 movies with the membership you are wasting $\\$8.25$.</i></p>	
---	--

Score 0

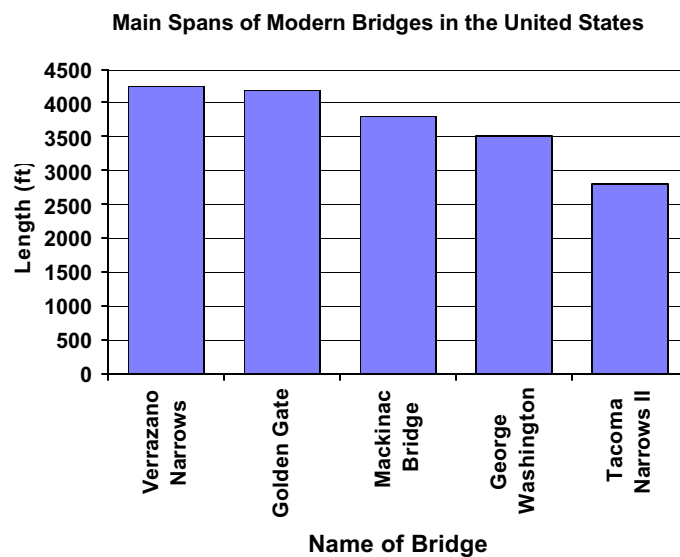
This is a 0-point response because the student shows little understanding of the content of the item.

#36

STUDENT RESPONSES AND SCORING

A **4-point** response does all of the following:

- Correctly chooses the five longest bridges from the table
- Accurately displays the lengths on a graph, choosing an appropriate scale if applicable
- Gives the graph an appropriate title and labels
- Gives an adequate reason for choosing the graph (e.g., a bar graph compares information and I was trying to compare the spans of bridges in the United States.”



A **3-point** response does one of the following or similar:

- Constructs a graph that displays the lengths of the five longest bridges and gives a logical justification for the choice but makes two or less minor errors (e.g., omits or gives one inappropriate label or title, chooses one incorrect bridge, incorrectly graphs the length of one bridge, etc.)
- Accurately constructs the graph including all labels and a title, but the justification for the choice is flawed or incomplete

A **2-point** response does one of the following or similar:

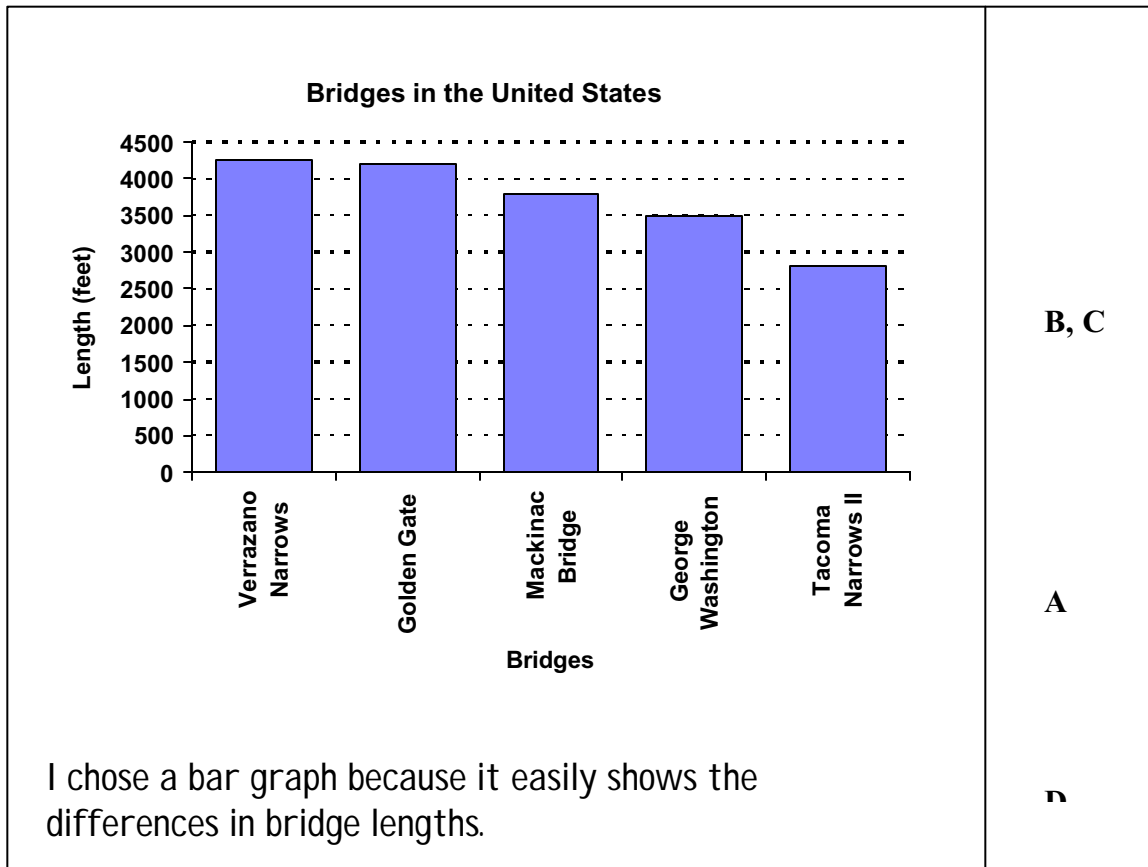
- Constructs a graph that displays the lengths of the five longest bridges and gives a logical justification for the choice but makes three or four minor errors (e.g., omits or gives one inappropriate label or title, chooses one incorrect bridge, incorrectly graphs the length of one bridge, etc.)

- Accurately constructs the graph including all labels and a title, but the justification for the choice is missing

A **1-point** response attempts to construct a graph comparing the bridge spans and shows some understanding of types of data displays, but the graph shows major errors or omissions. The student may or may not give a justification for choosing the graph.

A **0-point** response shows no understanding of graphing techniques or of types of data displays or leaves the item blank.

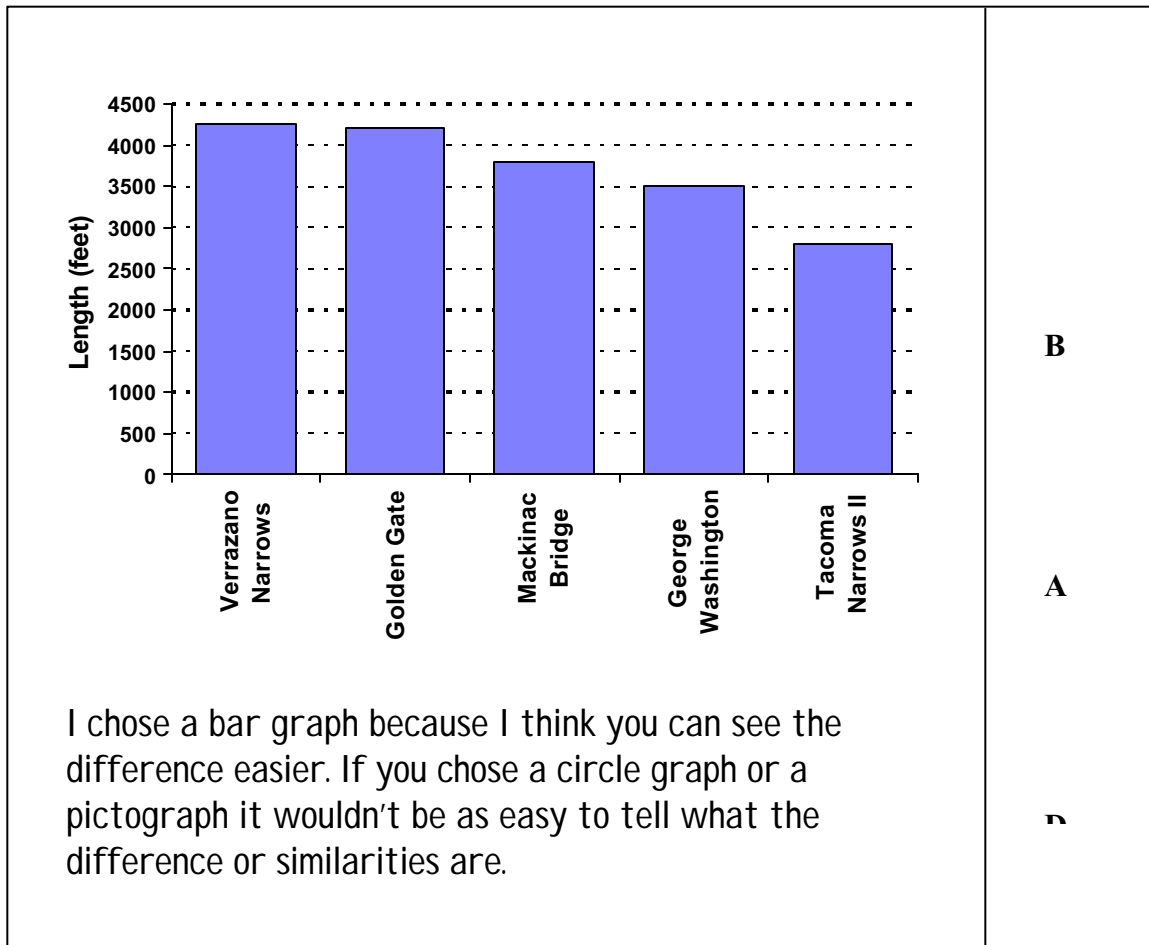
Student Response (4 points)



Score 4

This is a 4-point response because the student **(A)** correctly chooses the 5 longest bridges from the table, **(B)** accurately graphs the lengths, **(C)** gives the graph appropriate labels and title, and **(D)** gives an adequate reason for choosing the graph.

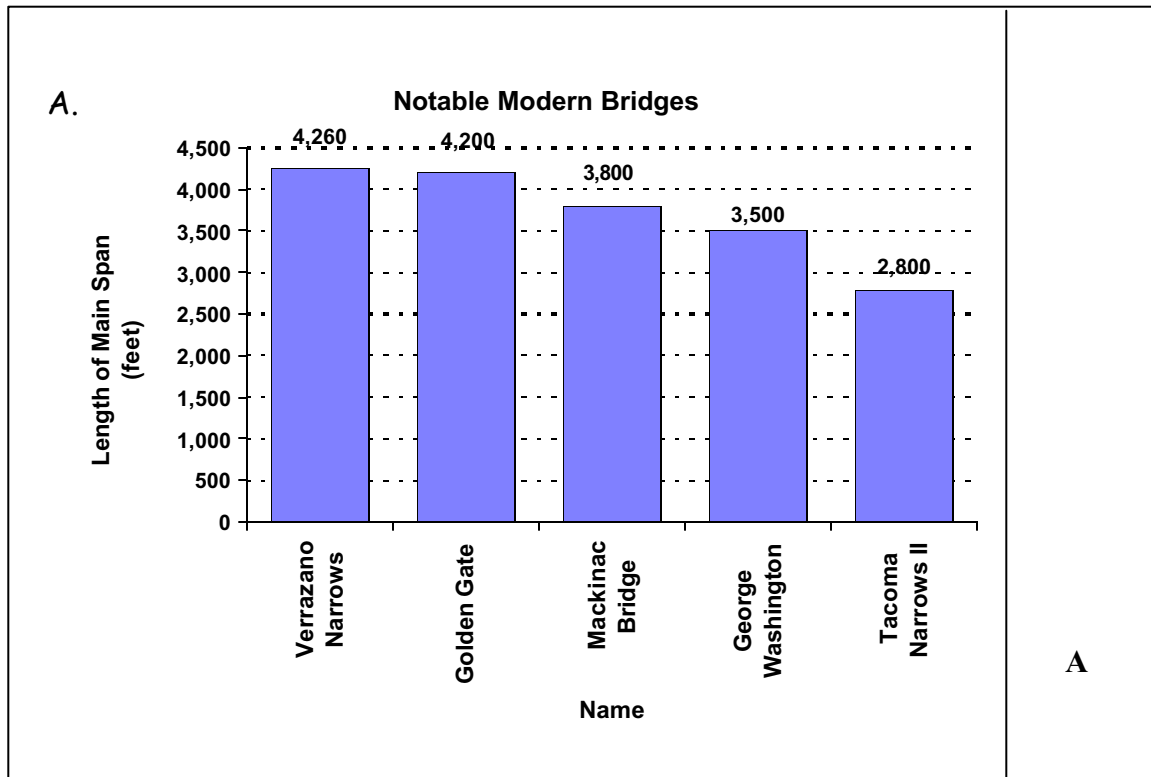
Student Response (3 points)



Score 3

This is a 3-point response because the student **(A)** correctly chooses the 5 longest bridges from the table, **(B)** accurately graphs the lengths, and **(D)** gives an adequate reason for choosing the graph, however a label and the title are missing.

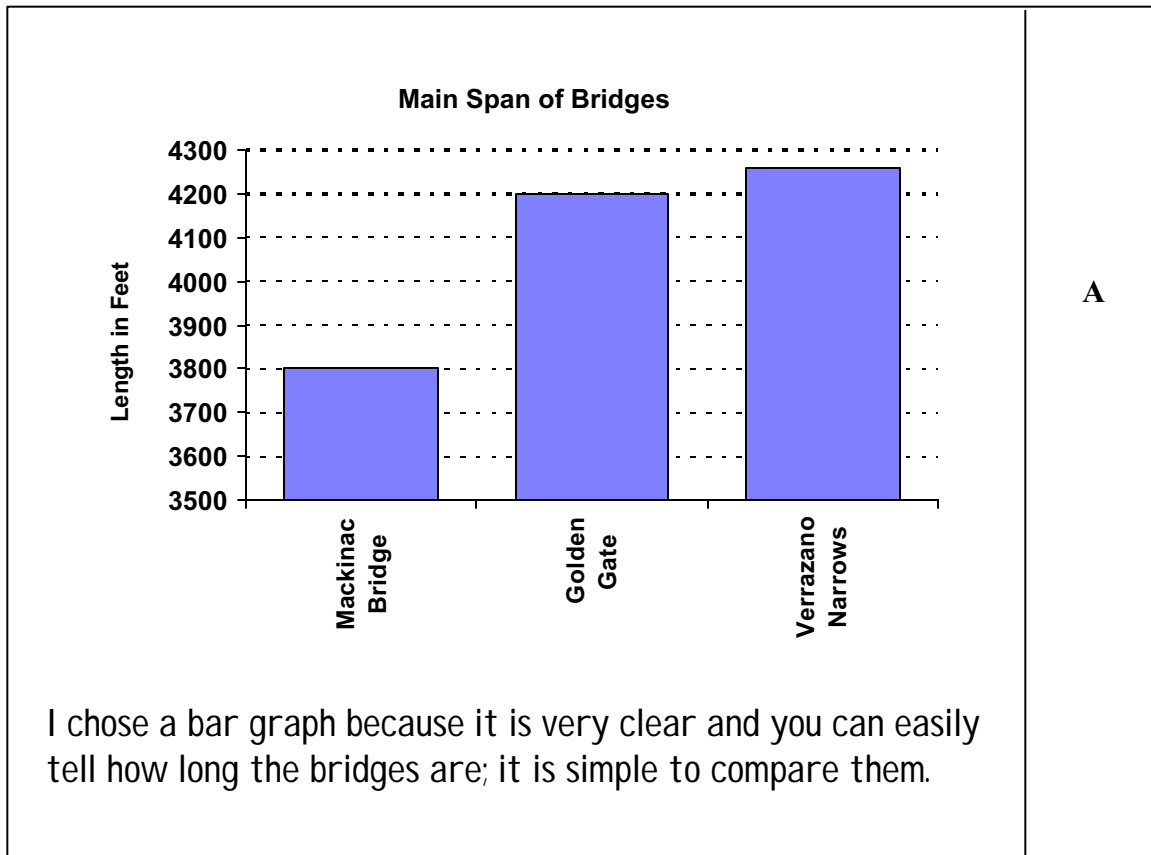
Student Response (2 points)



Score 2

This is a 2-point response because the student (A) accurately constructs the graph including all labels and a title, but the justification for the choice is missing.

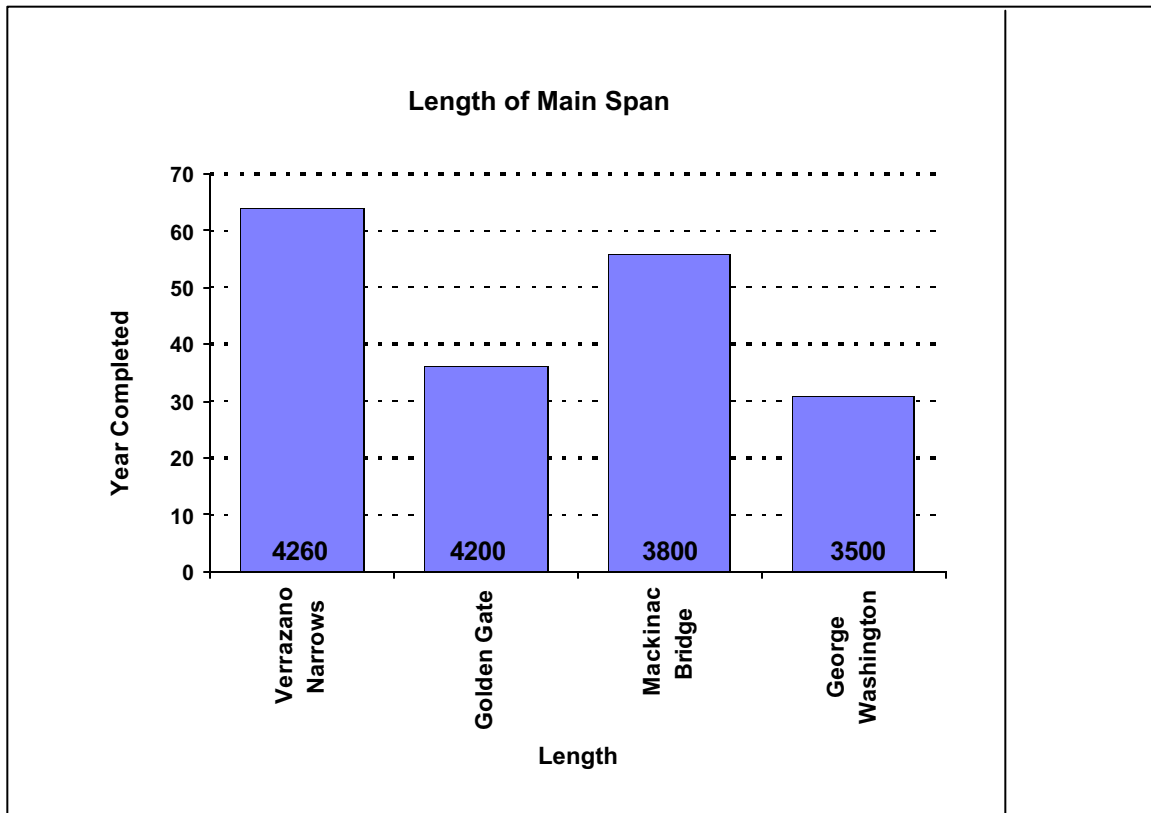
Student Response (1 point)



Score 1

This is a 1-point response because the student (**A**) attempts to construct a graph comparing bridge spans and shows some understanding of types of data displays, but the graph shows major omissions; (i.e. 2 of the 5 bridges, scale does not go to zero).

Student Response (0 points)



Score 0

This is a 0-point response because the response does not meet the requirements of a 1-point response.

ANSWER GRID

Item	Benchmark	Answer
1	4.1.1	C
2	2.2.4	B
3	3.2.2	A
4	6.1.*	B
5	1.1.1	D
6	2.3.*	B
7	5.2.2	A
8	1.2.4	A
9	4.3.5	B
10	3.2.1	D
11	6.1.*	C
12	5.2.5	C
13	1.1.5	OE
14	4.2.1	D
15	5.1.2	B
16	1.2.1	A
17	3.1.4	C
18	2.1.7	C
19	6.1.*	D
20	5.1.1	D
21	1.1.3	C
22	2.1.4	OE
23	5.2.5	OE
24	4.3.2	B
25	6.2.2	A
26	2.3.5	C
27	3.3.4	B
28	1.2.3	A
29	5.2.4	B
30	2.1.5	A
31	3.3.4	D
32	1.1.5	C
33	6.2.1	D
34	5.1.4	A
35	4.1.4	D
36	3.1.3	OE

* This item assesses both the strand and the standard, but does not match one specific benchmark.

PART FOUR: RESOURCES AND ACKNOWLEDGMENTS

GLOSSARY

Analytic Scoring: The awarding of separate scores for different traits or dimensions of a student's work.

Assessment: The gathering of evidence to judge a student's demonstration of learning. Aids educational decision making by securing valid and reliable information to indicate whether students have learned what is expected.

Benchmark: A statement of what students are expected to learn at various developmental levels (i.e., elementary school, middle school, and high school) to indicate progress made toward meeting a content standard.

Content Standard: A statement indicating what students are expected to know and be able to do by the time they graduate.

Context: General topics expected to be included in the content of a K–12 curriculum that serve as a basis for test items. Context can make the value of mathematics evident.

Curriculum: A coherent plan for a designated period of time specifying the content that students are expected to understand and apply. Normally includes standards, benchmarks, and a sequence of content that serve as the basis for instruction and assessment.

Holistic Scoring: Scoring based on an overall impression of a work rather than on an accumulation of points.

Instruction: The decisions and actions of teachers before, during, and after teaching to increase the opportunities for student learning.

Performance Standards: A description of performance levels based on mathematics content standards and benchmarks. Performance standards serve as a bridge between what is taught and what is tested.

Prompt: Information presented in a test item that activates prior knowledge and requires analysis in order for a student to respond.

Scoring Rubric: A scoring rubric is a tool for evaluating student performance on an assessment task. Includes a set of criteria used to determine the level of a student's performance.

Subject Area: A body of content derived from related disciplines and organized for curriculum.

Strand: A category for classifying the content standards of a subject area curriculum. The mathematics content standards are categorized into six strands: patterns, relationships and functions, geometry and measurement, data analysis and statistics, number sense and numeration, numerical and algebraic operations and analytical thinking, probability and discrete mathematics.

MATHEMATICS EDUCATIONAL RESOURCES

Following are web addresses that contain mathematics educational resources consistent with the Michigan Curriculum Framework.

The Michigan Department of Education at <www.mde.state.mi.us> The state curriculum framework and resources associated with the framework.

The Michigan Department of Treasury – Merit Board at <www.meritaward.state.mi.us> The site for MEAP including state assessment data.

The Michigan Council of Teachers of Mathematics (MCTM) at <mictm.org> The state's professional organization for mathematics education.

The National Council of Teachers of Mathematics (NCTM) at <nctm.org> The nation's professional organization for mathematics education. This site also contains an electronic version of the national mathematics standards.

Macomb Intermediate School District at <<http://www.macomb.k12.mi.us/>> A leading intermediate school district in the development of mathematics education materials.

The Eisenhower National Clearinghouse for Mathematics, Science, and Technology (ENC) at <enc.org> Our national mathematics education clearinghouse.

The North Central Regional Educational Laboratory (NCREL) houses the ***Midwest Mathematics and Science Consortia*** (a USDOE funded program) at <www.ncrel.org/msc/msc.htm> Our regional resource for mathematics, science, and technology education.

The Third International Mathematics and Science Study (TIMSS) at <<http://timss.bc.edu>> The latest, and most comprehensive, study in the status of international mathematics education.

The National Assessment of Educational Progress (NAEP) at <<http://nces.ed.gov/nationsreportcard/site/home.asp>> The national assessment and the nations' report card for mathematics education.

The NSF-funded comprehensive instructional materials projects' Implementation Centers:

Elementary Instructional Materials: The ARC Center at <www.comap.com/arc>

Middle School Instructional Materials: The Show-Me Center at <showmecenter.missouri.edu>

High School Instructional Materials: COMPASS at <www.ithaca.edu/compass>

**MICHIGAN DEPARTMENT OF EDUCATION
MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM**

MATHEMATICS ASSESSMENT PLANNING COMMITTEE

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Oakland University
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MEAP GRADE 8 MATHEMATICS TEST

Reference Sheet

Use this information as needed to answer questions on the MEAP Grade 8 Test.

Miscellaneous

Distance = rate \times time

Interest = principal \times rate \times time

Circumference of a circle = $\pi d = 2\pi r$

$\pi \approx 3.14$ or $\frac{22}{7}$

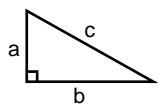
Algebra

Straight Line: $y = mx + b$

If (x_1, y_1) and (x_2, y_2) are on a line,
then

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Triangles



$$a^2 + b^2 = c^2$$

Examples:

$$3^2 + 4^2 = 5^2$$

$$5^2 + 12^2 = 13^2$$

Area



Triangle:

$$A = \frac{1}{2}(\text{base}) \times \text{height}$$



Rectangle:

$$A = \text{base} \times \text{height}$$



Trapezoid:

$$A = \frac{1}{2}(\text{sum of the bases}) \times \text{height}$$



Parallelogram:

$$A = \text{base} \times \text{height}$$



Circle:

$$A = \pi r^2$$

Total Surface Area

Cylinder: $SA = \text{circumference of the base} \times \text{height} + 2\pi r^2$

Cube: $SA = 6 \times (\text{length of edge})^2$

Volume



$$V = \pi r^2 \times \text{height}$$



$$V = (\text{length of edge})^3$$